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# BANZARE holothuroids (Echinodermata: Holothuroidea)

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## Abstract

The holothuroid species collected by The British, Australian and New Zealand Antarctic Research Expedition (BANZARE) are listed, with some systematic annotations. A previous report by O'Loughlin on some BANZARE holothuroids is revised and incorporated. Four new species are described: the Antarctic dactylochirotid *Echinocucumis kirrilyae* **sp. nov.**; the Kerguelen dendrochirotid *Clarkiella deichmannae* **sp. nov.**; the Antarctic dendrochirotids *Trachythyone cynthiae* **sp. nov.** and *Trachythyone mackenzieae* **sp. nov.** *Cucumaria serrata* var. *intermedia* Théel from Heard and Kerguelen, and *Cucumaria serrata* var. *marionensis* Théel from Marion, are raised to species status, and assigned to *Pseudocnus* Panning. *Cucumaria (Semperia) ekmani* Ludwig & Heding is a junior synonym of *Cucumaria kerguelensis* Théel. *Cucumaria kerguelensis* is re-assigned to *Neopsolidium* Pawson. *Thyone recurvata* Théel and *Cucumaria squamata* Ludwig are junior synonyms of *Trachythyone muricata* Studer. *Cucumaria (Semperia) bouvetensis* Ludwig & Heding is formally re-assigned to *Trachythyone*. *Trachythyone baja* Hernández is a junior synonym of *Trachythyone bouvetensis* (Ludwig & Heding). Molecular genetic data indicate possible allopatric cryptic Antarctic forms for the morpho-species *Laetmogone wyvillethomsoni* Théel. A table with all species and station data is provided.

**Key words:** Antarctica, Kerguelen, Macquarie, Marion, Tasmania, new species, synonymies, generic re-assignments

## Introduction

The British, Australian and New Zealand Antarctic Research Expedition (BANZARE), under the command of Sir Douglas Mawson, comprised two research voyages by the *Discovery.* The first voyage left Cape Town in October 1929 and worked off southern Africa, Crozet, Heard, eastern Antarctica (40˚–80˚E), Kerguelen and south-western Australia. The second voyage left Hobart in November 1930 and worked off southern Tasmania, Macquarie, Scott, eastern Antarctica (60˚–180˚E), and eastern Tasmania. Johnston (1937) published station data. In the *BANZARE Reports* John (1939) reported on the Crinoidea, Mortensen (1950) on the Echinoidea, A.M. Clark (1962) on the Asteroidea, and Madsen (1967) on the Ophiuroidea. *BANZARE Reports* are no longer published by the University of Adelaide and the remaining Echinodermata from BANZARE, the Holothuroidea, are reported here. The BANZARE holothuroid collection comprises 43 species in 123 lots.

Two BANZARE holothuroid species are conspecific with Australian National Antarctic Research Expedition (ANARE) species of *Trachythyone* that have been recognized from Prydz Bay in Antarctica but not yet described. New species are erected here to accommodate the BANZARE specimens, and the new taxa are based on ANARE material held in Museum Victoria (NMV; specimen registration prefix F).

O'Loughlin (2002) reported on BANZARE Apodida, Aspidochirotida, Elasipodida and some Dendrochirotida species, and this report is revised and all data incorporated in this paper. A paper by O'Loughlin & Ahearn (2008) on Antarctic and Sub-Antarctic species of *Psolidium* included BANZARE species, and data are included here. There is evidence within the BANZARE collection that Elizabeth Deichmann and Cynthia Gust Ahearn worked on some BANZARE lots, and their determinations are confirmed or revised.

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Recent molecular phylogenetic data from Antarctic and Sub-Antarctic holothuroids currently being generated by Gustav Paulay (pers. comm.) in the University of Florida indicate that the morpho-species (determinations based on traditional morphological systematics) are in many cases complexes of genetically different allopatric cryptic species. I am conscious that this work is reporting morpho-species, and there is morphological evidence that there may be allopatric cryptic species amongst the morpho-species. For example there are ossicle size differences for: Heard, Kerguelen and Macquarie specimens of *Pseudocnus laevigatus* (Verrill); Kerguelen and Antarctic specimens of *Staurocucumis liouvillei* (Vaney); Antarctic, Kerguelen and Magellanic specimens of *Taeniogyrus contortus* (Ludwig). There are ossicle form differences for Ross Sea and Prydz Bay, shallow and deep, specimens of *Laetmogone wyvillethomsoni* Théel. Resolution of the question of intra-specific variation or the existence of cryptic species should await the availability of appropriate molecular genetic data.

## Methods

The small dactylochirotid specimen was photographed by Chris Rowley using a Leica MZ16 stereomicroscope, DC300 Leica digital camera, and "Auto–Montage" software for composition of images. Other specimens were photographed by Leon Altoff and Audrey Falconer using a Pentax K10D camera, with an Olympus 80 mm f4 macro lens with bellows (larger specimens) and Olympus 38 mm f2.8 macro lens with bellows (smallest specimen). Digital images of ossicles were taken by Chris Rowley, with Mark O'Loughlin, using a Leica DM5000 B compound microscope with Leica DC500 digital camera and Auto–Montage Pro software.

All of the BANZARE holothuroids are registered to the South Australian Museum (SAM) with the prefix K, and lodged there.

## Apodida Brandt

### *Chiridota pisanii* Ludwig, 1886

**Remarks.** In my report (O'Loughlin 2002) on some ANARE and BANZARE specimens I listed *Chiridota pisanii* Ludwig, 1886 from Heard I., based on three ANARE NMV specimens. At that time hook ossicles were not detected in the specimens. These have been subsequently detected and the specimens now judged to be *Taeniogyrus contortus* (Ludwig, 1874). In the 2002 paper I unwisely combined ossicle measurement sizes of Tierra del Fuego and Heard specimens, compounding the identification mistake. This was appropriately addressed by Jens Bohn in Altnöder et al. (2007). *Chiridota pisanii* has not been found in the Kerguelen and Heard region.

## Dactylochirotida Pawson & Fell

### *Echinocucumis kirrilyae* sp. nov.

Figures 1a–d; table 1.

**Material examined.** Holotype. Eastern Antarctica, off Enderby Land, 65°48'S 53°16'E, 180–209 m, BANZARE stn 41, 24–25 Jan 1930, SAM K2457.

**Diagnosis**. Body 6 mm long (excluding tentacles); body wall calcareous with test of irregular, imbricating, spired scales; body fusiform, lacking oral and anal cones; mouth anterior; anus dorso-posterior;

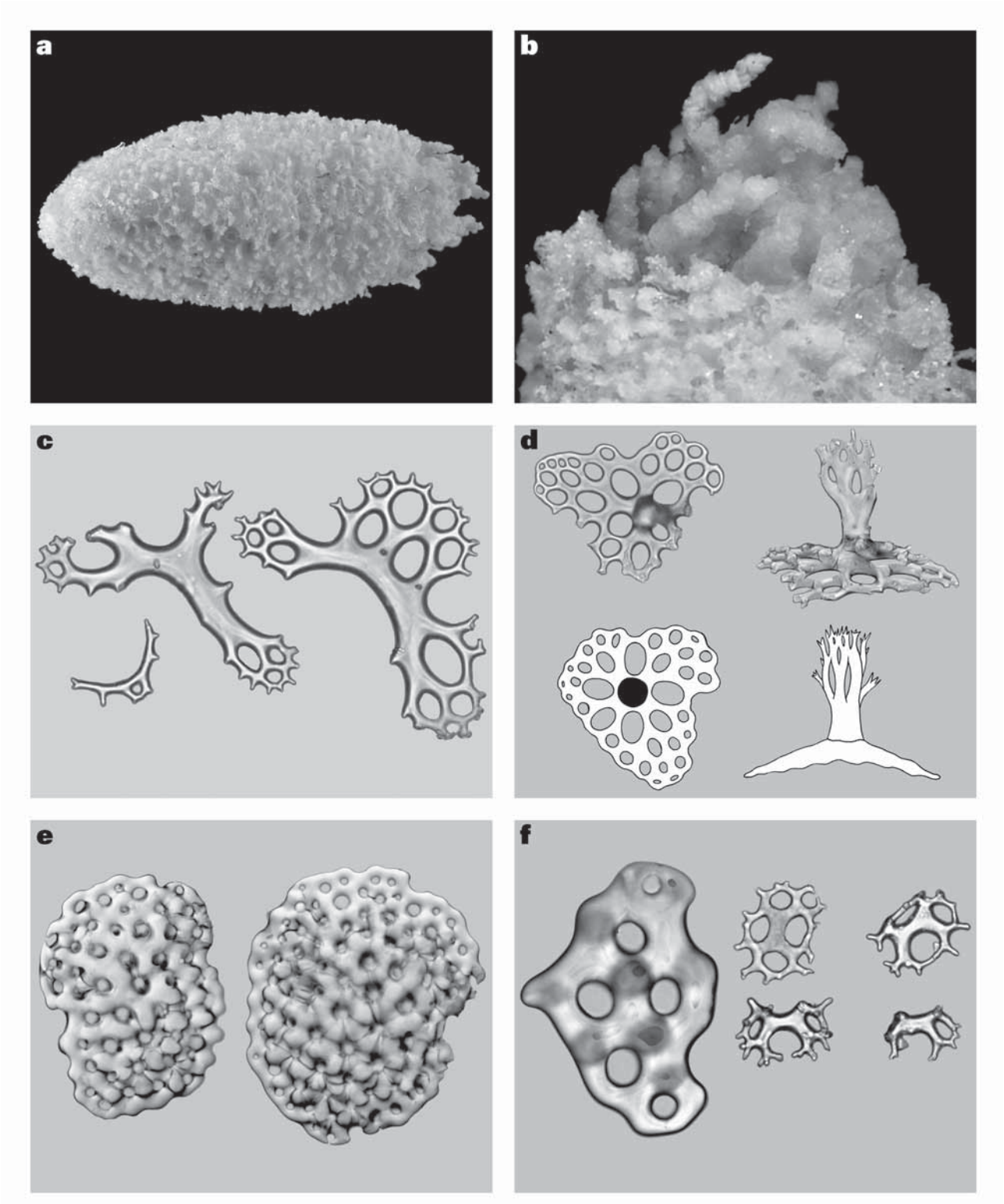


**FIGURE 1.** a–d, *Echinocucumis kirrilyae* **sp. nov**. holotype (SAM K2457, 6 mm long): a, right latero-ventral view showing series of tube feet; b, sub-digitiform tentacles; c, largest ossicles from tentacles (up to 224 $\mu$m long); d, ossicles from mid-dorsal body wall (photos upper, drawings lower), base plates (left, 424 $\mu$m long) and spires (right, 272 $\mu$m long). e, f, *Neopsolidium kerguelensis* (Théel, 1886): e, plates from mid-dorsal body wall with incipient secondary layering (up to 536 $\mu$m long, SAM K2304); f, small knobbed plate, cupped crosses, cups, from mid-dorsal body wall (cups up to 96 $\mu$m long, NMV F84997).

10 sub-equal sub-digitiform tentacles, with trunk and few short branches; single irregular spaced radial series of latero-ventral tube feet, a few tube feet on anterior and posterior mid-ventral radius; lacking tube feet dorsally and laterally; calcareous ring lacking posterior prolongations (ring fragmented); gonad tubules branched proximally; longitudinal muscles flat.

Body wall ossicles single-layered perforated plates, up to 424 $\mu$m diameter, irregular form around typically 4 large central perforations, tree-like spire arising centrally on plate between large perforations, up to 280 $\mu$m high, thick basal trunk branching openly, distal stout spines. Tentacle ossicles bent and curved rods, with central apical and terminal perforations, margin bluntly spinous; rods up to 272 $\mu$m long.

**Distribution.** Eastern Antarctica, off Enderby Land, 180–209 m.

**Etymology.** Named for Kirrily Moore, Technical Officer in the Tasmania Museum and Art Gallery, with appreciation of her gracious assistance in providing access to Antarctic and Sub-Antarctic holothuroid material.

**Remarks.** The single specimen is very small, but has distinctive and unique diagnostic characters. The new species is referred with reservations to *Echinocucumis* Sars, diagnosed most recently by Pawson (1970), because it has: 10 tentacles; calcareous ring lacking posterior prolongations; ventral radial tube feet; body plated with imbricating scales; ossicles single-layered perforated spired plates. It is referred with reservations because: body is fusiform and lacks oral and anal cones; tentacles are sub-digitiform and sub-equal; plates/scales are less than 500 $\mu$m diameter; spires arise centrally on the plates, between large central perforations. The ossicles show similarities with illustrations by Hansen (1988) of ossicles of very small specimens of dendrochirotid species of *Staurocucumis* and *Psolicucumis*. Hansen (1988) noted that the form of ossicles in juveniles raised doubts about the distinction between dactylochirotids and dendrochirotids. The presence of gonads in the type specimen indicates that it is not a juvenile. *Echinocucumis kirrilyae* **sp. nov.** is distinguished diagnostically within the dactylochirotids by the tree-like form of the centrally placed ossicle spires, each comprising a trunk with spreading, distally spinous, branches.

**Dendrochirotida Grube**

***Clarkiella deichmannae* sp. nov.**
Figure 2a–c; table 1.

**Material examined.** Holotype. Kerguelen Is, ? 278–329 m, BANZARE, 26 Feb 1930, SAM K2474. Paratypes. Type series, SAM K2375 (6). Other material. Off NE Tasmania, 41°03'S 148°42'E, 128–676 m, BANZARE stn 115, 24 Mar 1931, SAM K2367 (1).

**Diagnosis.** Up to 22 mm long (strongly contracted; excluding tentacles); body fusiform, lacking tail; mouth anterior, anus posterior; typically 15 dendritic tentacles, 5 pairs of large, 5 small between pairs (1 pair of small and total of 6 small in holotype); tube feet in 5 radial series, up to 4 wide, each series comprising 2 zig-zag rows (strong contraction of body creates superficial appearance of complete cover of tube feet); tube feet series cross introvert; calcareous ring lacks posterior prolongations, 5 long radial plates sub-rectangular with deep posterior "forked" notch, 5 long wide interradial plates with anterior taper and shallow posterior notch with upturned tapered outer ends.

Body wall ossicles abundant tables; discs irregularly round to slightly oval, typically 104 $\mu$m long (up to 112 $\mu$m), typically 16 perforations (8 central, 8 marginal), variably few or more; spires with 2 pillars, each comprising 2 fused pillars, 8–12 apical short stout spines, spires 48 $\mu$m high; tube foot endplate diameters 208 $\mu$m. Tentacle ossicles rod-derived perforated plates, variably elongate, branched, curved, up to 264 $\mu$m long.

**Distribution.** Kerguelen Is, NE Tasmania, 128–676 m (see Remarks).

**Etymology.** Named for Elizabeth Deichmann, formerly of Harvard University, with appreciative remembrance of her significant contribution to holothuroid systematics and in particular for her systematic work on some BANZARE specimens.

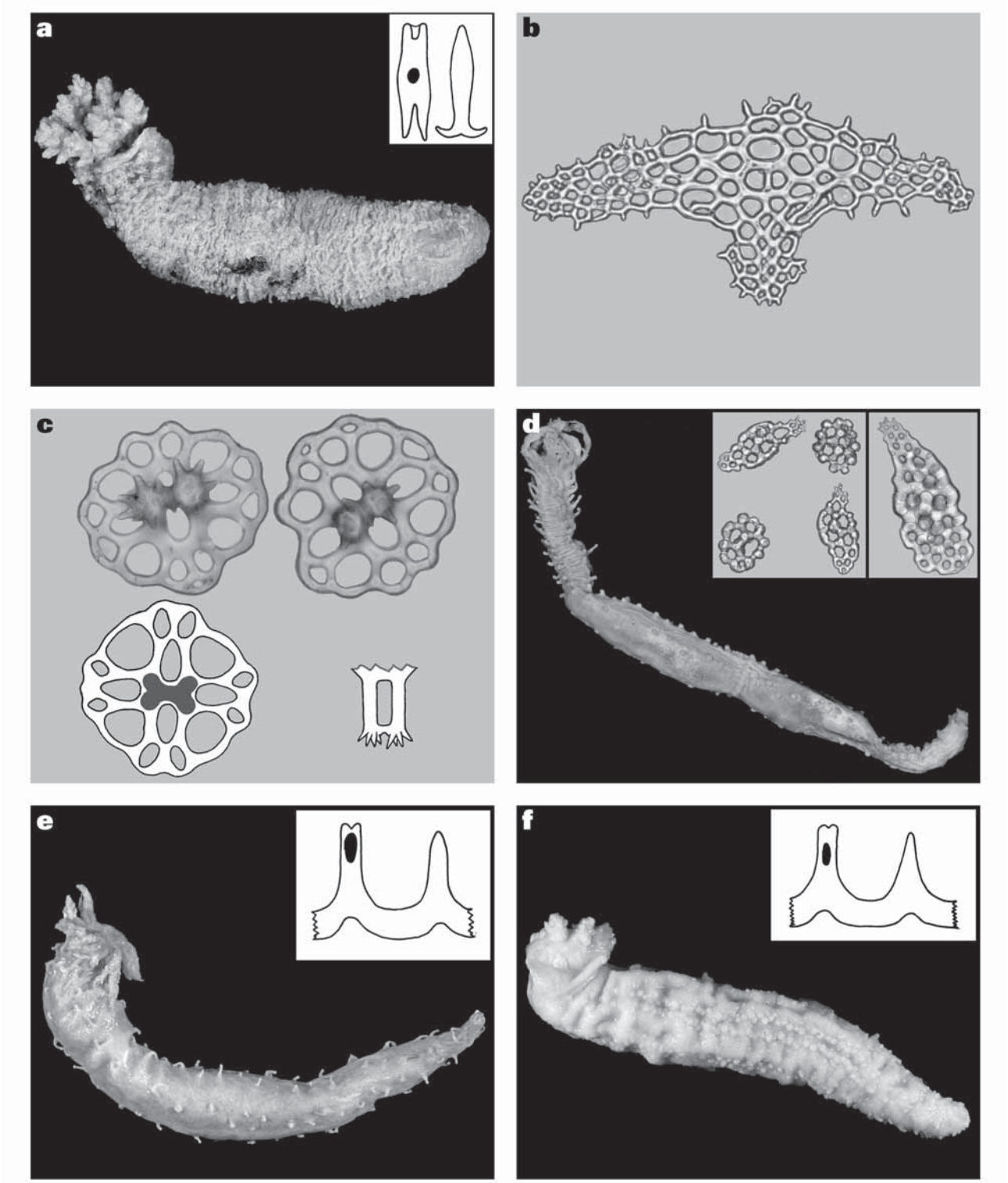


**FIGURE 2.** a–c, *Clarkiella deichmannae* **sp. nov.**: a, holotype (SAM K2474, 22 mm long), (insert) radial (left) and interradial plates of calcareous ring; b, large tentacle ossicle (264 $\mu$m long, paratype, SAM K2375); c, tables from mid-dorsal body wall (photos above, drawings below), discs (112 $\mu$m long) with spires (paratype, SAM K2375); d, *Pseudocnus intermedia* (Théel, 1886): thin elongate body (SAM K2384, 65 mm long), (left insert, NMV F84984) mid-dorsal body wall knobbed buttons (128 $\mu$m long) and terminally spinous plates (176 $\mu$m long). d (right insert): *Pseudocnus laevigatus* (Verrill, 1876): distally spinous plate from mid-dorsal body wall (220 $\mu$m long, SAM K2387). e, *Trachythyone cynthiae* **sp. nov.**: holotype (NMV F165718, 50 mm long), (insert) radial (left) and interradial plates of calcareous ring. f, *Trachythyone mackenzieae* **sp. nov.**: holotype (NMV F68073, 37 mm long), (insert) radial (left) and interradial plates of calcareous ring.

**Remarks.** In Heding & Panning (1954) Panning recorded that Svend Heding died before their manuscript was completed, and before Svend was able to complete a *Discovery* Report. Panning noted that descriptions of the new genus *Clarkiella* Heding, 1954 and new species *Clarkiella discoveryi* Heding, 1954 were from the notes of Heding, and were included in Heding & Panning (1954) in collaboration with Dr. E. Deichmann (Harvard University). *Clarkiella* was assigned to the new sub-family Cladolabinae Heding & Panning, 1954. The description of *Clarkiella discoveryi* refers to the largest specimen of the species as the 60 mm long "type", with 16 tentacles not the normal 15. The body was evenly covered with tube feet. No *Discovery* station data were referred to, or any specimen registration recorded. Panning (Heding & Panning 1954) recorded that the work on the *Discovery* material was taken over by Dr. Deichmann. This was not completed, and no *Discovery* Report has been published. All of the *Discovery* holothuroids that remained on loan to the Smithsonian US National Museum of Natural History are currently (July 2009) in Museum Victoria for determination, on their way to the British Museum of Natural History. Type material for *Clarkiella discoveryi* Heding, 1954 is not with the *Discovery* collection. The holotype is listed with the University of Copenhagen Zoology Museum holothuroid types (reg. no. ZMUC 64).

The diagnostic characters of the new species are similar to *Clarkiella discoveryi* Heding, 1954 from the South Atlantic, and the new species is assigned to *Clarkiella* Heding, 1954. There are insufficient data in the original description of *C. discoveryi* to conclude that it is conspecific with the Kerguelen material. No type locality or ossicle measurements were published. The type for *C. discoveryi* was significantly larger, and was covered evenly with tube feet. The specimens of *C. dichmannae* are strongly contracted, and initially it was thought that tube feet covered the body. It was subsequently recognized that they are in wide radial bands. The distinctive diagnostic characters of *Clarkiella deichmannae* **sp. nov.** are: fusiform body; 15 tentacles; ring lacking posterior prolongations; multiple rows radial series of tube feet; two–pillared spires on the tables, table discs slightly irregular with typically 8 central and 8 outer perforations and width 104 $\mu$m, spires typically 48 $\mu$m long.

Locality data are uncertain. No station number is recorded with the type material that was found with the BANZARE collection, but the date of collection is recorded as 26.2.1930. Johnston (1937) records station 60 and three shore collections on Royal Sound, Kerguelen I., on 25 February 1930, and station 61 and a shore collection on 27 February. The numbers 329–278 are recorded on the label and appear to indicate depth, presumably meters like other BANZARE depths. There is no uncertainty about station 115 (off Tasmania) for a single specimen that is judged here to be conspecific with the Kerguelen specimens. No other shallow holothuroid species has a common distribution of Kerguelen and Tasmania.

***Neopsolidium kerguelensis* (Théel, 1886)**
Figure 1e, f; table 1.

*Cucumaria kerguelensis* Théel, 1886: 69–70, pl. 12 figs 6, 7.—Lampert, 1889: 833–834 (as synonym of *Semperia parva* (Ludwig, 1874)).—Ludwig, 1898: 25–27, pl. 1 figs 14–18 (as synonym of *Cucumaria parva* Ludwig, 1874).—Perrier, 1905: 29.—Ekman, 1925: 93–96.—Ekman, 1927: 405.—Massin, 1992b: 316, figs 4, 5.
*Cucumaria (Semperia) ekmani* Ludwig & Heding, 1935: 186–188, figs 44, 45.
*Cucumaria (Semperia) kerguelensis*.—Ludwig & Heding, 1935: 186, 189–190, fig. 48.
*Trachythyone ekmani*.—Cherbonnier, 1974b: 29.

**Material examined.** Kerguelen I., Royal Sound, Port Jeanne d'Arc, 20 m, BANZARE stn 5, SAM K2369 (1); entrance to Bras Bossière, 4–5 m, sandy bottom, *Macrocystis* holdfasts, stn 6, SAM K2376 (1); 55 m, stn 15, SAM K2372 (11); S of Kerguelen I., 50 m, stn 47, SAM K2378 (2); SAM K2380 (1); Kerguelen I., shore collection and 20–30 m, stn 52, SAM K2370 (2); shore collection, stn 54, SAM K2373 (9); shore collection and 4–6 m, stn 56a, SAM K2371 (14); shore collection, stn 56b, SAM K2374 (2); 45 m, stn 59, SAM K2368 (1). Heard I., 90 m, SAM K2304 (1); 62–80 m, NMV F84997 (1); 230–247 m, NMV F85002 (1); 514–528 m, NMV F85003 (1); 60 m, NMV F85004 (1).

**Diagnosis.** Up to 55 mm long (excluding tentacles); body wall firm, leathery; distinct rounded belly with sole ventrally, rounded dorsally, tapered distally, distinct tail; 10 dendritic tentacles, ventral 2 smaller; smaller tube feet of variable size over dorsal and lateral body, anterior and posterior ends; 3 ventral radial series of larger tube feet on sole, each up to 4 rows wide, interradii narrow, bare on sole, not anteriorly or posteriorly; series of tube feet do not cross introvert; distinct, thin calcareous ring, radial and interradial plates elongate, narrow anteriorly, wide with rounded notch posteriorly; single polian vesicle; unbranched gonad tubules.

Mid-dorsal and mid-ventral body wall ossicles plates and cups; plates irregularly round to oval, perforated, knobbed, some with incipient secondary layering, up to 640 $\mu$m long; cups not abundant, variable in size and form and spination, 40–144 $\mu$m long, shallow to deep concave, typically 4 perforations, marginal "spines" pointed or knobbed or digitiform.

**Distribution.** Marion I., 52–351 m (Massin 1992b); Kerguelen Is, littoral to 55 m; Heard I., 60–528 m.

**Remarks.** The specimens examined here accord closely with the description of *Cucumaria kerguelensis* by Théel (1886) except that his largest specimen was 75 mm long (no record of tentacles included or not, and whether preserved or not), and cupped crosses only were reported (not cups). But Théel did record the presence of small plates with few perforations and presumably these were shallow concave plates/cups, as the cupped crosses that develop into cups were observed. He noted that the larger plates were composed of "several layers". Presumably this referred to the strongly developed incipient secondary layering seen in this study.

Ludwig & Heding (1935) distinguished their new species *Cucumaria (Semperia) ekmani* (type locality Kerguelen Is) from *Cucumaria kerguelensis* by the form of the calcareous ring, and the form of the cupped crosses and cups. The variations in form seen in this study of abundant material from the Kerguelen Is does not support these diagnostic distinctions. *Cucumaria ekmani* is a junior synonym of *Cucumaria kerguelensis*.

*Cucumaria kerguelensis* is similar to *Neopsolidium convergens* (Hérouard, 1901). It is reassigned here to the previously monotypic genus *Neopsolidium* Pawson, 1964 on the basis of having: 8 and 2 small ventral tentacles; sole with bare interradii, but not sharply distinguished from rest of body; small tube feet over dorsal and lateral body; cups and predominantly single-layered knobbed perforated plate ossicles up to 680 $\mu$m long in body wall.

*Neopsolidium kerguelensis* (Heard, Kerguelen Is) is distinguished from *Neopsolidium convergens* (Magellanic and South Atlantic region) by: larger size, up to 50 mm long (Perrier 1905 recorded up to 27 mm long, Pawson 1964 up to 22 mm long, for *N. convergens*); larger body wall plates up to 680 $\mu$m long with incipient secondary layering (Pawson 1964 diagnosed smooth, up to 400 $\mu$m long, for *N. convergens*); presence of cups ventrally (Pawson 1964 diagnosed *Neopsolidium* as lacking cups ventrally). The diagnosis of *Neopsolidium* Pawson is close to *Trachythyone* Studer, 1876, as evidenced by the fact that Lampert (1889) and Ludwig (1898) judged that the now *Neopsolidium kerguelensis* (this work) was a junior synonym of the now *Trachythyone parva*. A review of these genera should await molecular genetic data.

Massin (1992b) reviewed the systematic history of *Cucumaria kerguelensis* and agreed with Ekman (1925) who rejected earlier synonymies with *Cucumaria parva* by Lampert (1889) and Ludwig (1898). Ekman subsequently (1927) listed *Cucumaria kerguelensis* as a possible synonym of *Cucumaria parva*. I agree with Massin (1992b) that they are not synonyms.

***Pseudocnus intermedia* (Théel, 1886)**

Figure 2d; table 1.

*Cucumaria serrata* var. *intermedia* Théel, 1886: 74, pl. 3 fig. 6, pl. 4 fig. 2.
*Cucumaria laevigata* (Verrill, 1876).—Ekman, 1927: 396–403, fig. 15 (part non *Pseudocnus laevigatus* (Verrill, 1876)).

**Material examined.** Kerguelen Is, Bras Bossière, 4–5 m, BANZARE stn 6, SAM K2377 (8); Royal Sound, 2–20 m, BANZARE stn 49, SAM K2385 (4); Heard I., 85–93 m, ANARE HRD 002, NMV F84984 (1); 62–80 m, ANARE HRD 007, NMV F84982 (1).

**Diagnosis.** Body fusiform, elongate, thin, up to 80 mm long, 12 mm maximum diameter, tapered posteriorly; 10 subequal dendritic tentacles; tube feet in single to zig-zag radial series that cross introvert, sometimes sparse dorsally, closer on ventral radii; 5 anal scales; 'ring' not calcified; 3 polian vesicles; sexes separate, small male genital papilla.

Ossicles in mid-dorsal body wall abundant pear shaped plates and knobbed buttons; pear shaped / pine cone shaped plates extensively knobbed on surface and margin, one narrow end spinous, typically 4 large central perforations, perforations small distally, plates up to 176 $\mu$m long, commonly 120 $\mu$m long; knobbed buttons irregularly oval, not narrowed and spinous distally, typically 4 large central perforations, knobbed on surface and margin, buttons up to 128 $\mu$m long, typically smaller than spinous plates.

**Distribution.** Heard and Kerguelen Is, 2–275 m (Théel 1886).

**Remarks.** Ekman (1927) judged that *Cucumaria serrata* Théel, 1886 (and Théel's varieties *intermedia* and *marionensis*) were junior synonyms of *Cucumaria laevigata* (Verrill, 1876). The consistent and exclusive form of the ossicles in the Heard and Kerguelen material examined here support the recognition by Théel (1886) of both *Cucumaria serrata* and *Cucumaria serrata* var *intermedia*, although Théel did not recognize the similarity of *Cucumaria serrata* with *Pseudocnus laevigatus* (Verrill, 1876). The status of *Cucumaria serrata* and the generic assignment of the species will be treated in a paper on Heard I. holothuroids. In this work *Cucumaria serrata* var. *intermedia* Théel, 1886 is raised out of synonymy, and the variety is raised to species status. The species is re-assigned to *Pseudocnus* Panning, 1949 on the basis of: 10 equal tentacles; weakly developed calcareous ring lacking posterior prolongations; pear shaped / pine cone shaped knobbed ossicles, spinous at the narrow end; oval knobbed buttons. It is distinguished amongst *Pseudocnus* species by radial only series of tube feet, and presence of both knobbed spinous pear-shaped ossicles and knobbed oval buttons, both shorter than 180 $\mu$m long. The two ossicle forms are similar to the Magellanic species *Pseudocnus dubiosus leoninus* (Semper, 1868), but this latter species has a complete cover of tube feet.

The descriptive characters of the specimen of *Pentactella laevigata* Verrill, 1876 from only 22 m at Kerguelen I. raises the possibility that what is being described here as *Pseudocnus intermedia* is Verrill's species. Verrill's description of the size being 80 mm long by 24 mm diameter better describes what is judged here to be *P. laevigatus* than the thinner-bodied *P. intermedia* (80 mm long by 12 mm diameter).

***Pseudocnus laevigatus* (Verrill, 1876)**

Figure 2d insert; table 1.

**Distribution.** Heard, Kerguelen and Macquarie Islands, littoral to 528 m (Heard I., this work).

**Remarks.** *Pentactella laevigata* Verrill, 1876 was described for a single specimen from the Kerguelen Is, and the species later assigned to *Pseudocnus* Panning, 1949 by Panning (1962). Pawson (1968) discussed a possible "co-type" specimen of *Pentactella laevigata* (USNM cat. No. 3148), but noted that the presence of conspicuous ventral brood pouches that Verrill did not mention, and presence of a calcareous ring that Verrill reported as absent, cast doubt on the type status of this specimen. The largest illustrated ossicle length from the type in Pawson (1968) is 124 $\mu$m, and average length reported as 110 $\mu$m. These are significantly smaller than reported below (160 and 200 $\mu$m) for Kerguelen specimens.

*Pseudocnus laevigatus* (Verrill) is the most abundant holothuroid from the Kerguelen Is in the BANZARE collection. Théel (1886) also reported abundant *Challenger* specimens, and his description of the material, including loss of ossicles with size, also describes the BANZARE specimens. Except that the figures in the first of his two sets (Théel 1886, pl. 3 fig. 5) are a good illustration of the ossicles of *Cladodactyla crocea* (Lesson). The figures do not match Théel's second set of figures (pl. 6, fig. 13), and do not match his text. In the 1886 *Challenger* Report Théel's description of *Cucumaria crocea* Lesson from the South Atlantic follows his description of *Cucumaria laevigata* Verrill. I presume that pl. 3 fig. 5 has been mistakenly placed with *C. laevigata* instead *C. crocea*. This presumption is supported by the facts that the only figures for *C. crocea* (pl. 12 figs 1, 2) are of body form, and Théel's description of the ossicles of *C. crocea* clearly refers to pl. 3 fig. 5.

Massin (1992b) was misled by this mistake in his discussion of Marion I. holothuroids, and included the *Cucumaria laevigata* figures in his synonymy for *Cladodactyla crocea croceoides* (Vaney). In the extensive sampling of the Kerguelen Is by BANZARE neither *Cladodactyla crocea* nor *Cladodactyla crocea croceoides* was found. The species found on the Kerguelen Is that most closely resembles the juvenile specimens described by Massin (1992b) as *Cladodactyla crocea croceoides* is *Staurocucumis liouvillei* (Vaney, 1914).

Ekman (1927) distinguished a South American form from the Kerguelen form of *Cucumaria laevigata* and erected *Cucumaria perrieri* for the former. Panning (1962) considered the distribution of *Pseudocnus laevigatus* to be Prince Edward, Crozet, Kerguelen and Heard Islands. Some, if not all, of the Prince Edward and Crozet material may prove to be *Pseudocnus marionensis* (Théel, 1886) (see below). I would add Macquarie I. to Panning's distribution, but note that there is morphological evidence that *Pseudocnus laevigatus* on these islands is probably an allopatric species complex. Maximum body length: Heard 44 mm (this work); Kergulen 130 mm (this work; Théel 1886, 115 mm); Macquarie 15 mm (this work; Pawson 1968, 25 mm). Maximum pear shaped ossicle lengths: Heard 128 $\mu$m (this work); Macquarie 144 $\mu$m (this work; Pawson 1968, average 110 $\mu$m); Kerguelen 200 $\mu$m (this work; Théel 1886, 160 $\mu$m). In this work ventral brood pouches were observed in a few Heard I. specimens (NMV F85005), but not in Kerguelen or Macquarie specimens. The Heard lot of 26 specimens was collected on 28 September from 528 m. Only a few specimens had ventral brood pouches, with eggs and embryos and juveniles at various stages of development. Pawson (1968) did not observe brood pouches in Macquarie specimens.

### *Pseudocnus marionensis* (Théel, 1886)

*Cucumaria serrata* var. *marionensis* Théel, 1886: 74–75, pl. 4 fig. 3.
*Cucumaria laevigata* (Verrill, 1876).—Ekman, 1927: 396–403, fig. 15 (part non *Pseudocnus laevigatus* (Verrill, 1876)).
*Pseudocnus laevigatus*.—Pawson, 1971: 288–289.—Rowe & Clark, 1975: 187–188 (non *P. laevigatus*).

**Distribution.** Marion Is, 92–1007 m (Théel 1886).

**Remarks.** Ekman (1927) judged that *Cucumaria serrata* Théel, 1886 (and Théel's varieties *intermedia* and *marionensis*) were junior synonyms of *Cucumaria laevigata* (Verrill, 1876). *Cucumaria serrata* var. *intermedia* Théel, 1886 (Heard and Kerguelen Islands) is raised out of synonymy above. *Cucumaria serrata* var. *marionensis* Théel, 1886 (Marion Is) is raised out of synonymy here. The maximum lengths of the specimens (60 mm) and ossicles (150 $\mu$m) (from Théel 1886, Pawson, 1971, Rowe & Clark 1975) support the recognition by Théel (1886) of this variety.

Pawson (1971) examined littoral specimens from Marion I. that he judged to be *Pseudocnus laevigatus*. He reported a maximum length of 38 mm, and average ossicle length of 133 $\mu$m. In discussing the holothuroids of Marion I., Rowe (in Rowe & Clark 1975) affirmed the Ekman (1927) synonymy of *Cucumaria serrata* var. *marionensis* with *Pseudocnus laevigatus*. Rowe reported the largest specimen as 60 mm long (55 mm in Théel 1886), and largest pear shaped ossicles as 150 $\mu$m long (same as Théel 1886). The material examined by Pawson and Rowe appears to be conspecific with Theel's variety. These sizes are significantly smaller than for the Kerguelen specimens of *P. laevigatus* (130 mm, 200 $\mu$m) and *P. intermedia* (80 mm, 176 $\mu$m) discussed above. While recognizing the Théel variety I do not reject the possibility that *Pseudocnus laevigatus* also occurs on the Marion Is, as both *P. laevigatus* and *P. intermedia* both occur on the Kerguelen Is. Pawson (1971) reported two distinct colour forms (white and orange) for his *Pseudocnus laevigatus* on Marion I, possibly indicating two species.

Pawson (1971) observed ventral brood-pouches on one Marion specimen, and Rowe (in Rowe & Clark 1975) observed them on only the largest syntype of the Théel variety.

The variety *Cucumaria serrata* var. *marionensis* Théel, 1886 is raised here to species status, and assigned to *Pseudocnus* Panning, 1949 for the reasons given above for *Pseudocnus intermedia*. This species (type locality Marion Is) is distinguished diagnostically from *Pseudocnus intermedia* (Théel, 1886) (type locality

Heard and Kerguelen Is) by the size parameters referred to above. It is distinguished amongst *Pseudocnus* species by radial series only of tube feet, and presence of both knobbed spinous pear-shaped ossicles and knobbed oval buttons, both shorter than 150 $\mu$m long. The two ossicle forms are similar to the Magellanic species *Pseudocnus dubiosus leoninus* (Semper, 1868), but that species has a complete cover of tube feet.

### *Pseudopsolus macquariensis* var. *gruai* Cherbonnier, 1974

**Remarks.** Cherbonnier (1974b) erected this variety of a Macquarie I. species based on 16 specimens found in the rocky shallows of the Kerguelen Is. In the extensive sampling of the Kerguelen Is by BANZARE neither *Pseudopsolus macquariensis* (Dendy, 1896) nor this variety was found. Many specimens of *P. macquariensis* were found in the rocky shallows of Macquarie I.

### *Trachythyone bouvetensis* (Ludwig & Heding, 1935)

*Cucumaria (Semperia) bouvetensis* Ludwig & Heding, 1935: 188–189, figs 46, 47.
*Ludwigia bouvetensis*.—Panning, 1949: 431.
*Ocnus bouvetensis*.—Panning, 1971: 29 (by implication of synonymy of *Ludwigia* with *Ocnus*).
*Trachythyone baja* Hernández, 1987: 161–165, fig. 1, pl.
*Trachythyone bouvetensis*.—Gutt, 1991: 322, 324.—Massin, 1992a: 190–191.

**Remarks.** *Cucumaria bouvetensis* Ludwig & Heding, 1935 has the diagnostic characters of *Trachythyone* Studer, 1876: 8 and 2 small dendritic tentacles; *Cucumaria*-like calcareous ring; tube feet dorsally and laterally, and on 3 ventral radii; body wall ossicles large perforated plates and small spinous cups with 4–armed cross. Panning (1949) initially referred the species to *Ludwigia* Reiffen, and then by implication to *Ocnus* Forbes when he (Panning 1971) judged *Ludwigia* to be a junior synonym of *Ocnus*. The species has been referred to *Trachythyone* by Gutt (1991) and Massin (1992a). The species is formally referred here to *Trachythyone*.

When he erected his new species *Trachythyone baja* (Antararctic Peninsula and South Georgia), Hernández (1987) did not distinguish it from *Trachythyone bouvetensis* (Ludwig & Heding, 1935) (Bouvet I.). I have examined specimens (NMV) of *Trachythyone bouvetensis* from South Georgia, South Sandwich Is, South Shetland Is and Prydz Bay. The Hernández description and illustrations of *Trachythyone baja* are good descriptions of *Trachythyone bouvetensis*. The two species are judged here to be synonyms.

Species of *Trachythyone* on the coast of Antarctica are: *Trachythyone bouvetensis* (Ludwig & Heding, 1935); *Trachythyone cynthiae* **sp. nov.** (below); *Trachythyone mackenzieae* **sp. nov.** (below); *Trachythyone maxima* Massin, 1992a and possibly *Trachythyone parva* (Ludwig, 1874) (listed in Gutt, 1991; not confirmed in this work).

### *Trachythyone cynthiae* sp. nov.

Figures 2e, 3a, c, e; table 1.

*Trachythyone* sp. MoV 2003 O'Loughlin et al., 1994: 552.

**Material examined.** Holotype. Eastern Antarctica, Prydz Bay, 67°41'S 77°16'E, 333–341 m, ANARE AA91 stn 75, C.C. Lu & T.N. Stranks, 17 Feb 1991, NMV F165718.

Paratypes. Type locality and date, NMV F68087 (3); Prydz Bay, 307–319 m, ANARE 87 stn 23, NMV F165717 (5); 188–208 m, ANARE 87 stn 31, NMV F161551 (2).

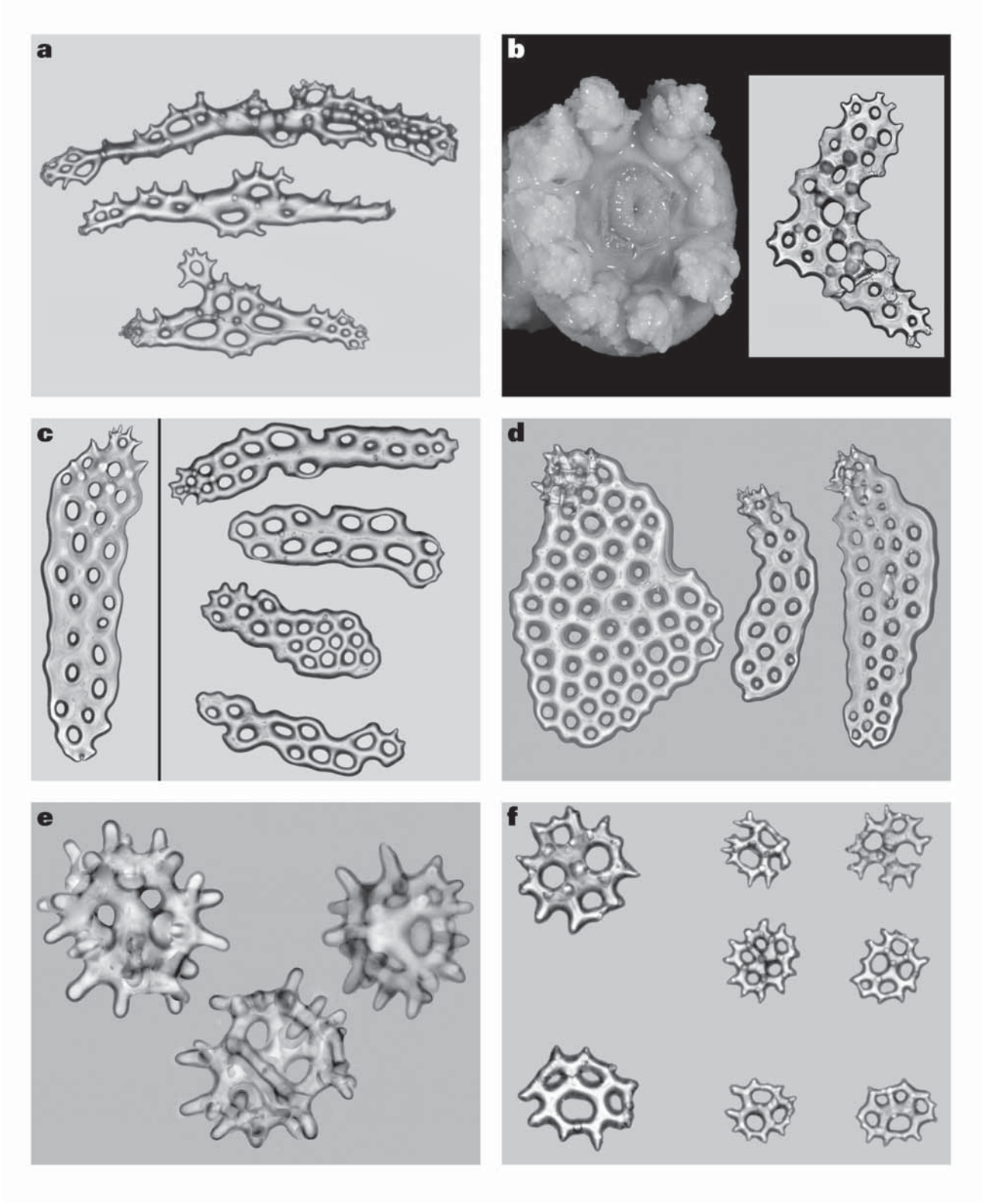


**FIGURE 3.** a, c, e, *Trachythyone cynthiae* **sp. nov.** ossicles: a, largest spinous perforated rods from tentacles (up to 840 $\mu$m long, holotype, NMV F165718); c, plates from mid-dorsal body wall (up to 584 $\mu$m long, SAM K2422); e, cups from mid-dorsal body wall (up to 64 $\mu$m long, NMV F165718, SAM K2422). b, d, f, *Trachythyone mackenzieae* **sp. nov.** (holotype, NMV F68073): b, 10 tentacles, 2 small ones (right), bluntly spinous perforated tentacle plate (up to 536 $\mu$m long); d, plates from mid-dorsal body wall, with terminal thick spires (up to 528 $\mu$m long); f, cupped crosses, cups from mid-dorsal body wall (up to 88 $\mu$m long).

**Other material.** Enderby Land, 193 m, BANZARE stn 41, SAM K2423 (2); 220 m, BANZARE stn 42, SAM K2422 (32); 690–911 m, 50°E ANARE, NMV F61505 (1); MacRobertson Land, 177 m, BANZARE stn 107, SAM K2424 (6); 109–121 m, ANARE, NMV F69119 (2); 118 m, NMV F68667 (1); Fram Bank, 145–150 m, NMV F68093 (5); 304 m, NMV F161483 (3); 105–114 m, NMV F68666 (1); 204–216 m, NMV F68665 (2); 795–830 m, NMV F68664 (1); 98–301 m, NMV F68091 (2); 444–453 m, NMV F68098 (7); Prydz Bay, 307–319 m, NMV F161511 (2); 505–578 m, NMV F161491 (1); 405–439 m, NMV F68069 (1).

**Diagnosis.** Body elongate, fusiform, tapered posteriorly, distinct tail; up to 60 mm long (preserved, excluding tentacles); body wall parchment-like, thin, calcareous, not rugose; 10 dendritic tentacles, ventral pair small; tube feet thin, elongate, not retractile, in radial series, predominantly single spaced series, sometimes zig-zag to double rows, radial rows symmetrical around body, series do not cross introvert; calcareous ring lacking posterior prolongations, radial plates with narrow sub-rectangular anterior projection, interradial plates with digitiform projection tapered anteriorly, all plates with rounded notch posteriorly; single polian vesicle; gonad tubules long, thin, unbranched.

Mid-dorsal body wall ossicles thick perforated plates, spinous cups; plates elongate, narrow, predominantly 2 perforations wide, plates up to 608 $\mu$m long, lacking knobs over most of plate, some plates with knobs and terminal pointed spines at one end, not spinous spires; cups round to slightly oval, typically 64 $\mu$m long (up to 72 $\mu$m), deep, bluntly spinous, spines sub-digitiform, cups frequently closed by bridges across rim. Multi-layered scale ossicles anally, irregular pear shape, up to 680 $\mu$m long. Tentacle ossicles rod-derived perforated plates, round to oval to elongate, curved to bent to cupped, thick blunt margin and surface spines, plates up to 880 $\mu$m long.

**Distribution.** Eastern Antarctic coast, 50°–77°E, 98–911 m.

**Etymology.** Named for my esteemed and valued colleague the late Cynthia Gust Ahearn, formerly Echinoderm Museum Specialist in the United States National Museum of Natural History in the Smithsonian Institution in Washington DC, with particular appreciation of Cynthia's role in sending the BANZARE collection of holothuroids to Museum Victoria for my attention.

**Remarks.** The distinguishing diagnostic characters of *Trachythyone cynthiae* **sp. nov.** amongst Antarctic and Sub-Antarctic *Trachythyone* species (*T. bouvetensis*, *T. mackenzieae* **sp. nov.** (below), *T. maxima* and possibly *T. parva*) are: predominantly single radial series of non-retractile tube feet; narrow body wall plates, frequently with knobs and marginal spines at one end; frequent closure of cups by bridges across rim.

***Trachythyone mackenzieae* sp. nov.**

Figures 2f, 3b, d, f; table 1.

**Material examined.** Holotype. Eastern Antarctica, Prydz Bay, Fram Bank, 67°25'S 70°20'E, 161–165 m, ANARE AA91 stn 94, C.C. Lu & T.N. Stranks, 26 Feb 1991, NMV F68073.

Paratypes. Fram Bank, 67°31'S 69°02'E, 105–114 m, AA93 stn 130, M. O'Loughlin, 13 Feb 1993, NMV F68668 (1); off Kaiser Wilhelm Land, 65°48'S 89°49'E, 393 m, BANZARE stn 100, 3 Feb 1931, SAM K2451 (1).

**Diagnosis.** Body elongate, fusiform, slightly tapered and rounded posteriorly; up to 60 mm long (preserved, excluding tentacles); body wall calcareous, rugose, not parchment-like; 10 dendritic tentacles, ventral pair small; tube feet in radial series, retractile, dorso-lateral radial series variable size, zig-zag to double discontinuous rows, 3 ventral radial series close zig-zag to double irregular rows; calcareous ring lacking posterior prolongations, radial plates with narrow sub-rectangular anterior projection, interradial plates with strongly tapered anterior projection, all plates with rounded notch posteriorly; single polian vesicle; gonad tubules long, thin, unbranched.

Mid-dorsal body wall ossicles thick perforated plates, spinous cups; plates irregularly oval to elongate, predominantly more than 2 perforations wide, plates up to 528 $\mu$m long, lacking knobs over most of plate, but frequently knobs, spines and thick low spinous spire above one end of surface of plate, about 160 $\mu$m high; irregular deep to shallow cupped crosses and cups, 48–88 $\mu$m long, blunt to pointed spines on rim, 4–8 perforations, perforations frequently small, no cups closed by bridges across rim. Tentacle ossicles rod-derived perforated plates, round to oval to elongate, curved to bent to cupped, thick blunt margin and surface spines, plates up to 536 $\mu$m long.

**TABLE 1**. List of holothuroids from BANZARE.

| Taxon | Registration (specimens) | Station | Locality | Latitude | Longitude | Depth |
|---|---|---|---|---|---|---|
| **Apodida** Brandt | | | | | | |
| *Taeniogyrus contortus* (Ludwig, 1874) | SAM K2384 (1) | 5 | Kerguelen Is | 49°33' S | 69°49' E | 20 m |
| | SAM K1839 (1) | 12 | Kerguelen Is | 49°28' S | 70°05' E | 4–5 m |
| | SAM K1840 (1) | 49 | Kerguelen Is | 49°30' S | 69°48' E | 2–20 m |
| **Aspidochirotida** Grube | | | | | | |
| *Bathyplotes bongraini* Vaney, 1914 | SAM K1836 (2) | 34 | E. Antarctica | 66°21' S | 58°50' E | 603 m |
| *Mesothuria bifurcata* Hérouard, 1901 | SAM K1838 (1) | 29 | E. Antarctica | 66°28' S | 72°41' E | 1266 m |
| *Pseudostichopus spiculiferus* | SAM K1851 (2) | 30 | E. Antarctica | 66°48' S | 71°24' E | 456 m |
| (O'Loughlin, 2002) | SAM K1850 (1) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K1853 (1) | 98 | E. Antarctica | 65°07' S | 107°29' E | 695 m |
| | SAM K1852 (7) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| **Dactylochirotida** Pawson & Fell | | | | | | |
| *Echinocucumis hispida* (Barrett, 1857) | SAM K2442 (5) | 29 | E. Antarctica | 66°28' S | 72°41' E | 1266 m |
| *Echinocucumis kirrilyae* sp. nov. | Holotype SAM K2457 | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| **Dendrochirotida** Grube | | | | | | |
| *Amphicyclus mortenseni* | SAM K2365 (7) | 113 | Tasmania | 42°40' S | 148°28' E | 122 m |
| Heding & Panning, 1954 | SAM K2363 (3) | 115 | Tasmania | 41°03' S | 148°42' E | 128 m |
| *Clarkiella deichmannae* sp. nov. | Holotype | 26.2.1930 | ? Kerguelen Is | – | – | ? 278 |
| | SAM K2474 | | | | | –329 m |
| | Paratypes (6) | 26.2.1930 | ? Kerguelen Is | – | – | ? 278 |
| | SAM K2375 | | | | | –329 m |
| | SAM K2367 (1) | 115 | Tasmania | 41°03' S | 148°42' E | 676 m |
| *Crucella hystrix* Gutt, 1990 | SAM K2443 (5) | 29 | E. Antarctica | 66°28' S | 72°41' E | 1266 m |
| | SAM K2448 (1) | 97 | E. Antarctica | 65°10' S | 108°12' E | 474 m |
| *Crucella scotiae* (Vaney, 1906) | SAM K2444 (1) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| *Cucumaria acuta* Massin, 1992 | SAM K2455 (10) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| | SAM K2456 (1) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2454 (2) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| | SAM K2460 (1) | – | E. Antarctica | 64°32' S | 97°20' E | – |
| | SAM K2462 (1) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| *Cucumaria georgiana* | SAM K2420 (1) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| (Lampert, 1886) Group | SAM K2458 (1) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| *Echinopsolus acanthocola* Gutt, 1990 | SAM K2468 (1) | 30 | E. Antarctica | 66°48' S | 71°24' E | 456 m |
| | SAM K2469 (1) | 39 | E. Antarctica | 66°10' S | 49°41' E | 300 m |
| | SAM K2467 (5) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| | SAM K2472 (9) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2471 (12) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| | SAM K2470 (4) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| *Heterocucumis denticulata* (Ekman, 1927) | SAM K2441 (1) | 90 | E. Antarctica | 66°21' S | 138°28' E | 640 m |
| | SAM K2452 (3) | – | Drygalski I. | – | 93° E | – |
| | SAM K2453 (1) | 105 | E. Antarctica | 67°46' S | 67°03' E | 163 m |
| *Heterocucumis godeffroyi* (Semper, 1868) | SAM K1845 (2) | 12 | Kerguelen Is | 49°28' S | 70°05' E | 4–5 m |
| | SAM K1844 (2) | 59 | Kerguelen Is | 49°28' S | 70°12' E | 47 m |
| *Heterocucumis steineni* (Ludwig, 1898) | SAM K1832 (1) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| *Neopsolidium kerguelensis* (Théel, 1886) | SAM K2369 (1) | 5 | Kerguelen Is | 49°33' S | 69°50' E | 20 m |
| | SAM K2376 (1) | 6 | Kerguelen Is | 49°30' S | 69°48' E | 4–5 m |
| | SAM K2372 (11) | 15 | Kerguelen Is | 49°27' S | 70°02' E | 55 m |
| | SAM K2378 (3) | 47 | Kerguelen Is | 49°50' S | 69°33' E | 150 m |
| | SAM K2370 (2) | 52 | Kerguelen Is | 49°37' S | 70°08' E | 30 m |
| | SAM K2373 (9) | 54 | Kerguelen Is | 49°37' S | 70°09' S | shore |
| | SAM K2371 (14) | 56A | Kerguelen Is | 49°24' S | 69°56' E | 0–6 m |
| | SAM K2374 (2) | 56B | Kerguelen Is | 49°25' S | 69°53' E | shore |
| | SAM K2368 (1) | 59 | Kerguelen Is | 49°28' S | 70°12' E | 45 m |
| *Paracucumis turricata* (Vaney, 1906) | SAM K1846 (4) | 97 | E. Antarctica | 65°10' S | 108°12' E | 474 m |
| *Pseudocnus intermedia* (Théel, 1886) | SAM K2377 (8) | 6 | Kerguelen Is | 49°29' S | 69°48' E | 4–5 m |
| | SAM K2385 (4) | 49 | Kerguelen Is | 49°30' S | 69°48' E | 2–20 m |
| *Pseudocnus laevigatus* (Verrill, 1876) | SAM K2398 (1) | 5 | Kerguelen Is | 49°33' S | 69°50' E | 20 m |
| | SAM K2426 (9) | 6 | Kerguelen Is | 49°29' S | 69°48' E | 4–5 m |
| | SAM K2436 (4) | 7 | Cascade River | – | – | 4 m |
| | SAM K2396 (1) | 11 | Kerguelen Is | 49°28' S | 70°05' E | 30 m |
| | SAM K2388 (74) | 47 | Kerguelen Is | 49°50' S | 69°33' E | 150 m |
| | SAM K2391 (3) | 50 | Kerguelen Is | 49°32' S | 69°48' E | 10 m |
| | SAM K2397 (1) | 52 | Kerguelen Is | 49°37' S | 70°08' E | 30 m |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Pseudocnus laevigatus* (Verrill, 1876) *(continued)* | SAM K2432 (11) | 15.2.1930 | Jeanne D'Arc | – | – | shore |
| | SAM K2429 (32) | 16.2.1930 | Jeanne D'Arc | – | – | shore |
| | SAM K2399 (4) | 55A | Kerguelen Is | 49°30' S | 9°49' E | 20 m |
| | SAM K2386 (4) | 56A | Kerguelen Is | 49°24' S | 69°56' E | 0–6 m |
| | SAM K2433 (15) | 56B | Kerguelen Is | 49°25' S | 69°53' E | shore |
| | SAM K2394 (5) | 59 | Kerguelen Is | 49°28' S | 70°12' E | 47 m |
| | SAM K2387 (21) | 64 | Kerguelen Is | 49°28' S | 70°33' E | 91 m |
| | SAM K2359 (68) | 83 | Macquarie I. | 54°43' S | 158°55' E | 69 m |
| *Pseudopsolus macquariensis* (Dendy, 1896) | SAM K2350 (2) | '1776' | Macquarie I. | – | – | shore |
| | SAM K2351 (65) | '1786' | Macquarie I. | – | – | shore |
| | SAM K2353 (22) | '1787' | Macquarie I. | – | – | shore |
| | SAM K2352 (84) | 81B | Macquarie I. | 54°29' S | 158°58' E | shore |
| *Psolicrux coatsi* (Vaney, 1908) | SAM K2401 (13) | 39 | E. Antarctica | 66°10' S | 49°41' E | 300 m |
| | SAM K2402 (3) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| | SAM K2405 (10) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2403 (7) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| *Psolicrux iuvenilesi* | SAM K2400 (1) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| O'Loughlin & Manjón-Cabeza, 2009 | SAM K2404 (1) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2464 (2) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| *Psolidium normani* | Paratypes (2) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| O'Loughlin & Ahearn, 2008 | SAM K2341 | | | | | |
| | Paratype (1) | 90 | E. Antarctica | 66°21' S | 138°28' E | 640 m |
| | SAM K2349 | | | | | |
| *Psolidium pawsoni* | SAM K2342 (2) | 34 | E. Antarctica | 66°21' S | 58°50' E | 603 m |
| O'Loughin & Ahearn, 2008 | | | | | | |
| *Psolidium poriferum* (Studer, 1876) | SAM K2344 (30) | 47 | Kerguelen Is | 49°50' S | 69°33' E | 150 m |
| | SAM K2343 (1) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| *Psolidium tenue* Mortensen, 1925 | SAM K2347 (1) | 97 | E. Antarctica | 65°10' S | 108°12' E | 474 m |
| | SAM K2348 (4) | 103 | E. Antarctica | 67°03' S | 74°29' E | 437 m |
| *Psolidium schnabelae* | Holotype | 29 | E. Antarctica | 66°28' S | 72°41' E | 1266 m |
| O'Loughlin & Ahearn, 2008 | SAM K2345 | | | | | |
| | SAM K2346 (2) | 29 | E. Antarctica | 66°28' S | 72°41' E | 1266 m |
| *Psolus arnaudi* Cherbonnier, 1974 | SAM K2414 (6) | 39 | E. Antarctica | 66°10' S | 49°41' E | 300 m |
| | SAM K2413 (1) | 105 | E. Antarctica | 67°46' S | 67°03' E | 210 m |
| *Psolus charcoti* Vaney 1906 | SAM K2411 (1) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| | SAM K2409 (7) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2410 (1) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| *Psolus cherbonnieri* | SAM K2415 (1) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| Carriol & Féral, 1985 | SAM K2418 (2) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| *Psolus dubiosus* Ludwig & Heding, 1935 | SAM K2416 (4) | 30 | E. Antarctica | 66°48' S | 71°24' E | 456 m |
| | SAM K2417 (1) | 103 | E. Antarctica | 67°03' S | 74°29' E | 437 m |
| *Psolus koehleri* Vaney, 1914 | SAM K2407 (1) | 103 | E. Antarctica | 67°03' S | 74°29' E | 437 m |
| | SAM K2408 (3) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| *Psolus parvulus* Cherbonnier, 1974 | SAM K2473 (4) | 40 | E. Antarctica | 66°12' S | 49°37' E | 300 m |
| *Staurocucumis liouvillei* (Vaney, 1914) | SAM K2439 (36) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2450 (2) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| | SAM K2438 (2) | 58 | Kerguelen Is | 49°30' S | 70°04' E | 50 m |
| | SAM K2440 (4) | 63 | Kerguelen Is | 49°29' S | 70°20' E | 39 m |
| | SAM K2446 (1) | 105 | E. Antarctica | 67°46' S | 67°03' E | 163 m |
| | SAM K1848 (4) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| | SAM K2465 (3) | 107 | E. Antarctica | 66°45' S | 62°03' E | 177 m |
| *Trachythyone cynthiae* sp. nov. | SAM K2423 (2) | 41 | E. Antarctica | 65°48' S | 53°16' E | 193 m |
| | SAM K2422 (32) | 42 | E. Antarctica | 65°50' S | 54°23' E | 220 m |
| | SAM K2424 (6) | 107 | E. Antarctica | 65°45' S | 62°03' E | 177 m |
| *Trachythyone lechleri* (Lampert, 1885) | SAM K2383 (2) | 47 | Kerguelen Is | 49°50' S | 69°33' E | 150 m |
| | SAM K1849 (1) | 59 | Kerguelen Is | 49°28' S | 70°12' E | 47 m |
| | SAM K2361 (1) | 80A | Macquarie I. | 54°28' S | 158°53' E | 120 m |
| | SAM K2360 (2) | 83 | Macquarie I. | 54°43' S | 158°55' E | 69 m |
| *Trachythyone mackenzieae* sp. nov. | Paratype (1) | 100 | E. Antarctica | 65°48' S | 89°49' E | 393 m |
| | SAM K2451 | | | | | |
| *Trachythyone macphersonae* | SAM K2357 (22) | '1786' | Macquarie I. | – | – | shore |
| Pawson, 1962 | SAM K2354 (9) | '1787' | Macquarie I. | – | – | shore |
| | SAM K2358 (2) | 81B | Macquarie I. | 54°29' S | 158°58' E | shore |
| | SAM K2355 (14) | 83 | Macquarie I. | 54°43' S | 158°55' E | 69 m |
| *Trachythyone muricata* Studer, 1876 | SAM K2379 (1) | 47 | Kerguelen Is | 49°50' S | 69°33' E | 150 m |
| **Elasipodida** Théel | | | | | | |
| *Amperima robusta* (Théel, 1882) | SAM K1842 (2) | 66 | Indian Ocean | 47°05' S | 79°16' E | 3112 m |
| *Laetmogone wyvillethomsoni* Théel, 1879 | SAM K1827 (1) | 30 | E. Antarctica | 66°48' S | 71°24' E | 456 m |
| | SAM K1828 (1) | 34 | E. Antarctica | 66°21' S | 58°50' E | 603 m |
| *Rhipidothuria racovitzai* Hérouard, 1901 | SAM K1829 (1) | 39 | E. Antarctica | 66°10' S | 49°41' E | 300 m |
| | SAM K1830 (24) | 40 | E. Antarctica | 66°12' S | 66°37' E | 300 m |
| | SAM K1831 (3) | 97 | E. Antarctica | 65°10' S | 108°12' E | 474 m |

**Distribution.** Eastern Antarctic coast, 70°–90°E, 105–393 m.

**Etymology.** Named for Melanie Mackenzie, Museum Victoria Research Associate, with appreciation of her valuable assistance in determining Antarctic holothuroid material.

**Remarks.** The distinguishing diagnostic characters of *Trachythyone mackenzieae* **sp. nov.** amongst Antarctic and Sub-Antarctic *Trachythyone* species (*T. bouvetensis*, *T. cynthiae* **sp. nov.** (above), *T. maxima* and possibly *T. parva*) are: calcareous rugose surface; paired radial series of retractile tube feet; thick spinous spires arising above one end of body wall plates.

### *Trachythyone muricata* Studer, 1876

*Trachythyone muricata* Studer, 1876: 453.
*Thyone recurvata* Théel, 1886: 94, pl. 5 fig. 7, pl. 8 fig. 6.
*Cucumaria squamata* Ludwig, 1898: 27–28, pl. 1 figs 19–21.
*Trachythyone squamata*.—Hernández, 1987: 163.

**Remarks.** *Trachythyone muricata* is the type species for *Trachythyone* Studer, 1876, and the Kerguelen Is are the type locality. The holotype of *Trachythyone muricata* (Museum fuer Naturkunde, Humboldt–Universitaet zu Berlin, ZMB 2252) is characterized by: fusiform elongate body, 70 mm long (90 mm long in Studer 1876), 12 mm mid-body diameter, long posterior taper; calcareous rugose body; tube feet cover body, hard, not retractile, no bare interradii; 10 dendritic tentacles, 2 ventral smaller; calcareous ring lacking posterior prolongations; body wall ossicles plates and cups; plates thick, single-layered, perforations small, some ridge thickenings but lacking knobs and spines, irregularly elongate, up to 596 $\mu$m long; cups thick, deep, oval to rectangular, up to 88 $\mu$m long, bluntly spinous rim, sometimes with bridges across rim. *Trachythyone muricata* is represented in the BANZARE collection by a single small specimen. It is represented in the SAM collections from Heard I. by an 82 mm long specimen (SAM K2302).

The description and figures for the single specimen of *Thyone recurvata* Théel, 1886 (type locality Kerguelen Is) are the same as the diagnostic characters of the type for *Trachythyone muricata*, and it is judged here to be a junior synonym. *Cucumaria squamata* Ludwig, 1898 was described for a single 30 mm long specimen from Betsy Cove (Kerguelen I.). The large smooth perforated plates and small rectangular bluntly spinous cups are diagnostically identical with the body wall ossicles of *Trachythyone muricata*, and it is judged here to be a junior synonym.

Ekman (1925) thought that *Thyone muricata* and *Thyone recurvata* (both with type locality Kerguelen Is) might be junior synonyms of *Cucumaria parva* Ludwig, 1874 (type locality Magellanic region; referred to *Trachythyone* by Panning 1949). Ekman (1927) subsequently listed *Trachythyone muricata* and *Thyone recurvata* as junior synonyms of *Cucumaria parva*. Ludwig & Heding (1935) distinguished *Thyone muricata* from their new species *Cucumaria (Semperia) ekmani* (type locality Kerguelen Is; synonymised above with *Neopsolidium kerguelensis*), but did not give an opinion on a relationship with *Thyone recurvata*. Panning (1964) also thought that *Trachythyone muricata* might be a junior synonym of *Trachythyone parva*. In a species list for Terre Adélie, Cherbonnier (1974a) listed *Trachythyone muricata* as a junior synonym of *Trachythyone parva*. I have found *Trachythyone bouvetensis* (Ludwig & Heding, 1935) in both the Ross Sea (New Zealand Institute of Water and Atmospheric Research, NIWA) and Prydz Bay (NMV) collections, and anticipate that the Terre Adélie specimens are *Trachythyone bouvetensis*. A possible synonymy of the geographically widely separated species *T. muricata* and *T. parva* is rejected here since *T. parva* has: smaller size, up to 31 mm long (Perrier 1905); tube feet confined predominantly to radii, especially ventrally; tube feet not noticeably hard and non-retractile; smaller perforated plate ossicles, 150 $\mu$m long (Perrier 1905).

The Antarctic and Sub-Antarctic species *Trachythyone bouvetensis* (type locality Bouvet I.) is covered dorsally and laterally by tube feet. It is distinguished from *Trachythyone muricata* by: distinct "belly" mid-body, not fusiform; tube feet not noticeably hard, non-retractile; bare ventral interradii; large perforated plates

(up to 520 $\mu$m long) frequently with four larger central perforations, sometimes sharply to bluntly spinous at one end; cups and cupped crosses up to 96 $\mu$m long, with long pointed spines.

The type species for the genus *Trachythyone* is completely covered by tube feet. Panning (1964) diagnosed the genus *Trachythyone* to include both radial only or overall distributions of tube feet. *Trachythyone cynthiae* **sp. nov.** and *Trachythyone mackenzieae* **sp. nov.** (above) have radial only series of tube feet. It is noted above that *Neopsolidium* Pawson is diagnostically very close to *Trachythyone*. Resolution of these systematic issues should await evidence from molecular genetic data.

**Elasipodida Théel**

***Laetmogone wyvillethomsoni* Théel, 1879**

**Remarks.** O'Loughlin et al. (1994) recognized morphological variations from the type specimens of *Laetmogone wyvillethomsoni* Théel, 1879 (southern Indo-Pacific, abyssal) in specimens from Prydz Bay (bathyal). Molecular phylogenetic data (Gustav Paulay, pers. comm.) for specimens of the morpho-species *L. wyvillethomsoni* from the Ross Sea indicate possible allopatric cryptic Antarctic species (shallow and deep bathyal). Whether these forms are conspecific with *Laetmogone wyvillethomsoni* remains to be determined.

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